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EOS SAR: A New Approach

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The Mission

Earth Observing System Goals:

Develop the modeling and observational capabilities to predict and/or monitor atmospheric, terrestrial and oceanic processes that are either causing global change or resulting from global change

EOS SAR Goals:

To provide important geophysical products to the EOS data set to improve our understanding of the state and functioning of the Earth system

EOS SAR Strategy:

Define the instrument requirements based on required input to geophysical algorithms

Provide the processing capability and algorithms to generate such products on the required spatial (global) and temporal (3-5 days) scales

Provide the spaceborne instrumentation with international partnerships

- initially with Germany
- currently exploring broader international partnerships

Geophysical Properties

Ecology:

Vegetation type

Water status

Biomass

Seasonal state

Fire extent

Hydrology:

Soil moisture

Snow moisture and extent

Inundation extent

Glacier zonation

Oceanography:

Sea ice type and motion

Wavelength and direction

Currents and eddies

Geology:

Landform distribution

Surface roughness

Subsurface structure and drainage

Progress in 1992

ERS-1 Polar Ice Results

- ERS-1/2 -> RADARSAT provide excellent data for polar ice community
- Polarimetric capabilities still required for thin ice type

Waring's SAR Vegetation Working Group (*Ecological Applications*)

- *Current understanding of vegetation products from SAR*
- *Value in ecosystem models*
- *Freeze/thaw*
- *Biomass (<150 tons/ha)*
- *Inundation extent*
- *Water status*

Engman's Hydrology Working Group and ISLSCP Workshop

- Soil moisture in root zone is the requirement
- Surface moisture measured by SAR may be related to soil moisture
- Algorithm independent of surface roughness developed (Ulaby)
- Shorter wavelength improves snow discrimination (Rott)

References

Operational Geophysical Products from SAR

<u>Product</u>	<u>Band</u>	<u>Reqmt's</u>	<u>Temporal</u>	<u>Reqmt's</u>
Current ASF for ERS-1:				
Sea ice motion	C-VV or C-HH		3-days	
Sea ice type	C-VV or C-HH		3-days	
Ocean wavelength and direction	C-VV or C-HH		weekly	
JERS-1:				
Landform distribution	L-HH		once	
Deforestation extent	L-HH		yearly	
ASF Upgrade for RADARSAT/ERS-2:				
Glacier zonation	C-VV or C-HH		yearly	
Freeze-thaw state	C-VV		< weekly	
Fire extent	C-VV or C-HH		monthly	
Inundation extent (tundra)	C-VV or C-HH		weekly	
SIR-C/X-SAR Free Flyer:				
Vegetation type	L-quad, C-quad, X-VV		winter and summer	
Regrowth biomass	L-quad		yearly	
Surface roughness	L-quad, C-quad, X-VV		yearly	
Subsurface structure/drainage	L-HH, high angle		once	
EOS SAR:				
Soil moisture (and roughness)	L-quad		3 days, constant time of day	
Snow moisture and extent	L-quad, C-quad, X		weekly, day-time	
Vegetation water potential/moisture	L-quad, C-quad, X		diurnal	
Thin ice type	L-quad		3 days	
Inundation extent (forests)	L-HH		weekly	

EOS SAR Mission Strategy: MultiSAR

Previous Strategy:

EOS SAR for all geophysical products:

- L- and C-band from US.
- X-band from Germany
- Single platform
- Mission start with EOS SAR launch

Potential International MultiSAR Strategy:

Obtain "baseline" global classification with SIR-C/X-SAR Free Flyer

- Geology products
- Vegetation type
- Regrowth biomass

Continue products started with ERS-1/2, JERS and RADARSAT

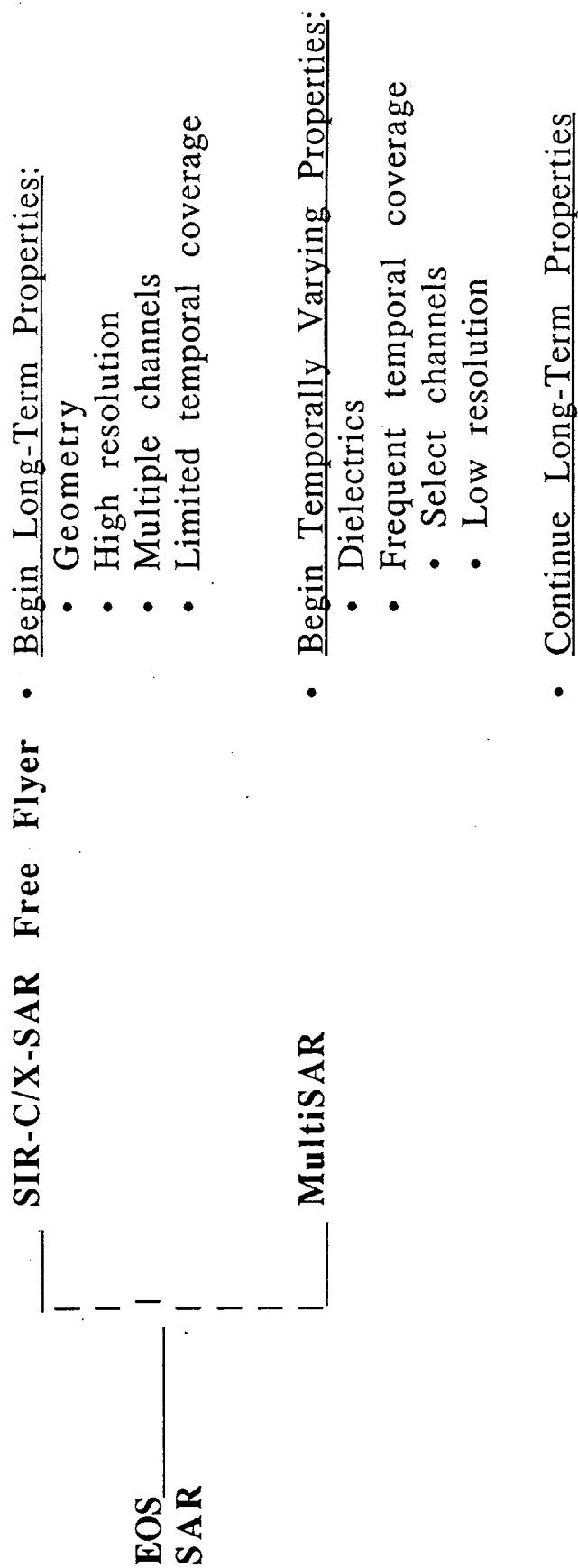
- Ice and ocean
- Glaciers

- Freeze/thaw, fire extent, inundation (tundra)

Design multiple spacecraft/SAR international mission series

- "hydrologic" properties
- change in "classification" properties

Split Concept for Global Data Products



Outstanding MultiSAR Requirements

- *Outstanding relative to current international program and SIR-C/X-SAR Free Flyer*

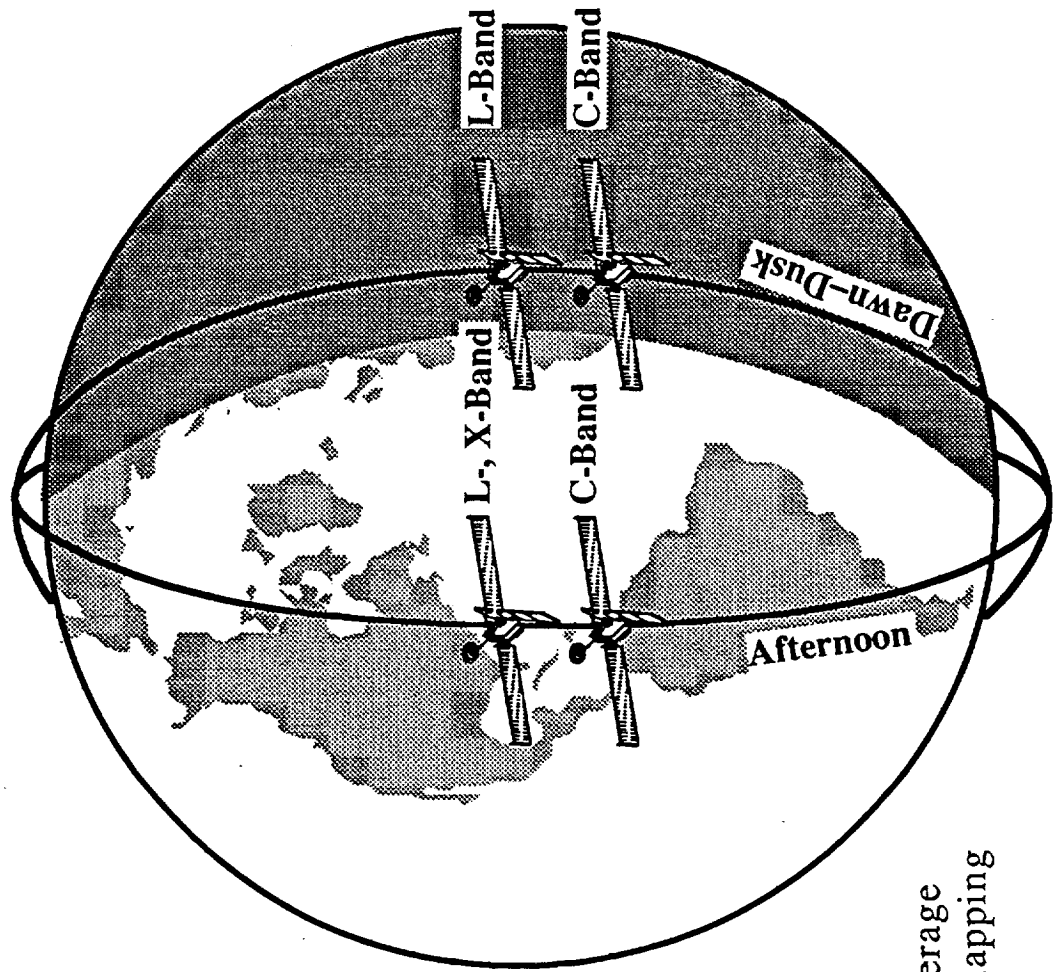
Data Products:

Product	Band Req'm't	Temporal Req'm't
Soil moisture (and roughness)	L-quad	3 days, constant time of day
Snow moisture and extent	L-quad, C-quad, X	weekly, day-time
Vegetation water potential/moisture	L-quad, C-quad, X	diurnal
Thin ice type	L-quad	3 days
Inundation extent (forests)	L-quad	weekly

New Requirements:

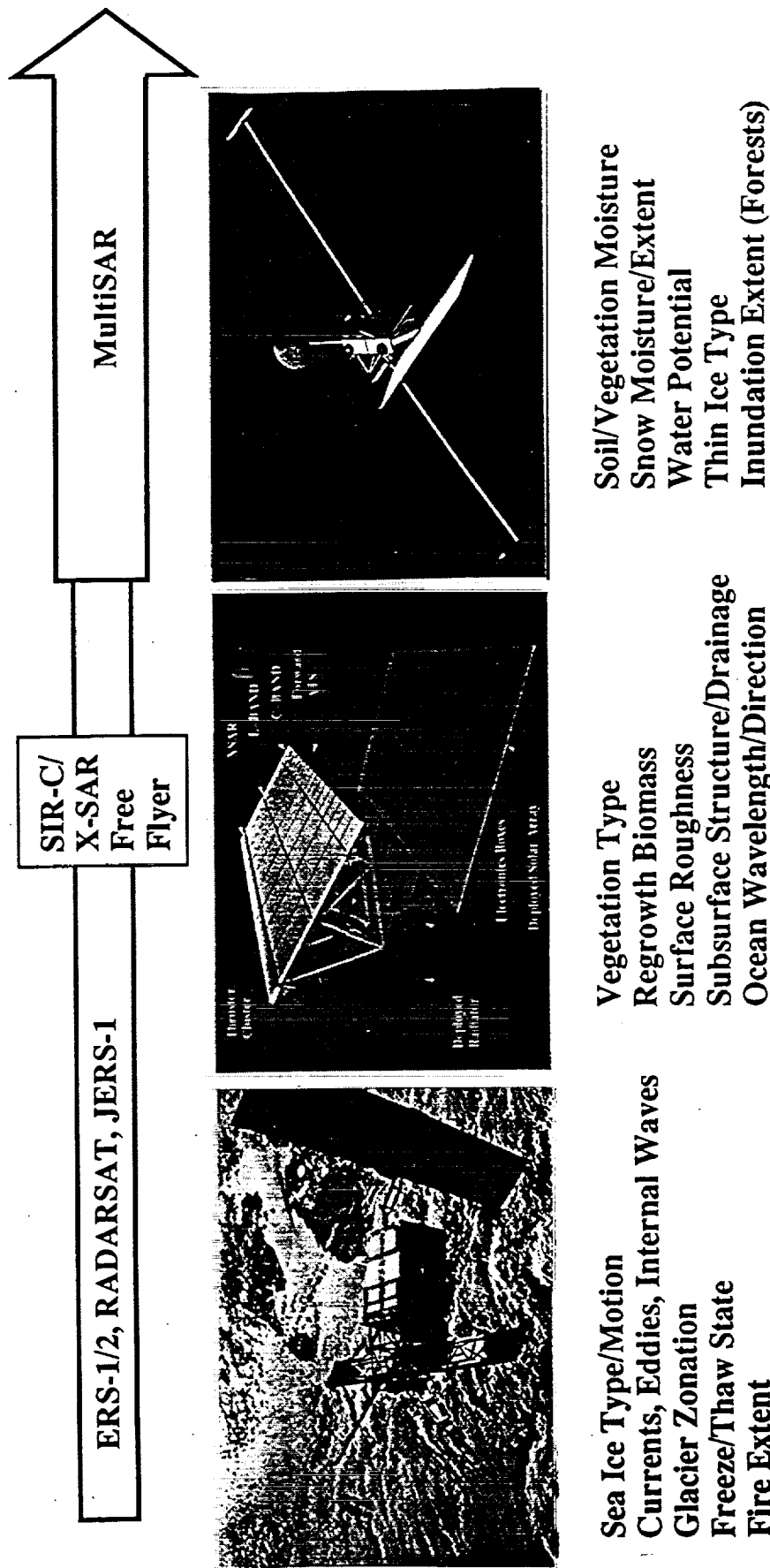
Frequency/polarization:	L-quad, C-quad, X
Resolution:	250 - 500 m (L, C), 30 m (X)
Swath width:	500 km (including quad)
Calibration:	<1dB relative lifetime
Repeat coverage:	3-5 days
Equator crossing time:	1:30 p.m., 1:30 a.m.; dawn, dusk
Duty cycle:	20-50%

Potential Synergism of International MultiSAR Mission



- diurnal coverage
- increased mapping

JPL Evolution of Geophysical Products Through Long-Term International Program



Conclusions

- Current international capabilities provide some temporally varying data products
- Multifrequency and multipolarization required for many products
- SIR-C/X-SAR Free Flyer provides initial look at long-term geophysical products
- Additional EOS SAR task is to add temporally varying water-related properties
 - must also continue long-term products
- International MultiSAR approach provides opportunity to optimize temporal multifrequency/pol. coverage of the globe

Next Steps

International agreement on science requirements

Series of discipline-oriented workshops and field campaigns

Mission scenario options for study

International approach to operational data product generation